Influence of outlet geometry on the swirling flow in a simplfied model of a large two-stroke marine diesel engine

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Influence of outlet geometry on the swirling flow in a simplified model of a large two-stroke marine diesel engine S. HAIDER, T. SCHNIPPER, K.E. MEYER, J.H. WALTHER, Department of Mechanical Engineering, Technical University of Denmark, S. MAYER, MAN Diesel & Turbo, Denmark — We present Stereoscopic particle image velocimetry measurements of the effect of a dummy-valve on the in-cylinder swirling flow in a simplified scale model of a large two-stroke marine diesel engine cylinder using air at room temperature and pressure as the working fluid and Reynolds number 19500. The static model has stroke-to-bore ratio of 4, is rotationally symmetric and the in-cylinder swirling flow is enforced by angled ports at the inlet. We consider a case analogous to engine when the piston is at bottom-dead-center. In absence of an exhaust valve the overall axial velocity profile is wake-like and flow reversal is observed on the cylinder axis, close to the inlet. Downstream, the flow reversal disappears and instead a localized jet develops. The corresponding tangential velocity profiles show a concentrated vortex with decreasing width along the downstream direction. By placing a concentric dummy-valve at the cylinder outlet, the magnitude of reverse flow at the inlet increases, the strong swirl is diminished and the axial jet disappears. We compare these findings with previous measurements in vortex chambers and discuss the relevance of these results with respect to development of marine engines.

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